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# MAJOR WEEDS OF *Gladiolus grandiflora* L. AND THEIR MANAGEMENT

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**ABSTRACT**

*Studies were conducted to identify the important weeds infesting Gladiolus grandiflora L. Family Iridaceae and to investigate the effects of various mulches (pine saw dust, pine wood chips, wheat straw, plastic mulch) and a herbicide as a check. Control (weedy check) was also included for comparison. The studies were conducted at Rawalakot valley of Azad Jammu and Kashmir, Pakistan. First of all, weed survey was conducted. While in the second experiment, weed management study was arranged in Randomized Complete Block Design. Data recorded showed that a total of 15 major weed species belonging to six different families were found in association with gladiolus. The fields were observed densely populated (7/15 weeds) with monocotyledonous belonging to family Poaceae. Among various mulching treatments, plastic mulch proved to be the most effective for inhibiting weed germination (10 weeds $m^{-2}$). However, it did not improve the growth and yield of gladiolus as compared to other mulching materials. Application of pine wood chips promoted plant height of G. grandiflora to almost double (283 cm) as compared to weedy check (143 cm). Numerically, higher values of corm size (6 cm), corm weight (40 g), cormel size (2.3 cm), cormel weight (1.4 g) and cormel yield (102.3 cormels $m^{-2}$) were observed in pine wood chips. The herbicide Gezapex Combi used as a standard, injured crop by stunting and chlorosis. Based on the present findings, it is concluded that weeds are a major constraint in G. grandiflora and mulching of pine wood chips in this crop improves yield and its other economic traits.*

**Key words:** gladiolus, herbicide injury, mulching, pine wood chips, weed management.

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## INTRODUCTION

Gladiolus (*Gladiolus grandiflora* L.); a member of family Iridaceae, is an important commercially grown flower in all the provinces of Pakistan and Azad Jammu and Kashmir (AJ&K). The favorable agro-climatic conditions of Kashmir make its production a promising business for the farmers as the income of the floriculture is higher than any other agricultural crops (Shaukat *et al.*, 2012). Due to small land holdings and terrace cultivation in the hills of Kashmir valleys, growers prefer to cultivate cut flowers as compared to growing traditional cereals. It has been documented that the environmental factors are also well suited for the production of quality flowers including gladiolus, rose tubes and lily (Ahmed and Siddique, 2005). A single home on the average earns about PKRs. 60-70 thousands in Rawalakot of Kashmir valley by growing gladiolus (Anon. 2013). However, the yield of gladiolus in the Kashmir valley is comparatively lower than its potential because of severe weed infestation and lack of knowledge for their control strategies. Weeds compete for water, nutrients and light resulting in reduced flower yield and increased threat of serious insect and disease problems that result in economic losses. Weeds dramatically compete with crops for nutrients, water and space, thus reduces the yield ranging from 12 to 51 % in various agricultural crops (Ullah *et al.,* 2014). Though, herbicides application has become a common practice, but the concerns about developing herbicide resistance in many plant species, deterioration of environment, and human health have recently discouraged many farmers to incorporate chemical control in their production strategies. Chemical-weed control is not really feasible for the farmers having small land holdings; while, for those having large area, employing labor for weeding is also time consuming and cumbersome (Marwat *et al.*, 2011). Therefore, an alternative weed management approach that would be cost-effective, labor-saving, and environment friendly, as a sustainable agricultural approach, is being focused throughout the world (Syed *et al.,* 2015).

A successful weed management program utilizes cultural practices such as cultivation and mulching, or a combination of cultural and chemical measures, taking into consideration labor costs and the cost and availability of materials. Organic farming, in particular, precludes the use of synthetic chemicals like fertilizers, herbicides, pesticides, growth regulators, livestock feed additives, etc. Among weed management practices in organic farming, application of mulch is

popular and considered skillful in affecting weed germination, growth, and hence control overall weed density. These practices also help in maintaining soil characteristics like water holding capacity, temperature and its nutritional status and thus improving the overall yield of crop (Younis *et al.,* 2012). Gladiolus flowers are contributing significantly in the economic development of farming communities of the Kashmir. The lack of basic information regarding identification of weeds flora in gladiolus, and non availability of effective and low-cost weed control methods are inflicting immense losses. Therefore, there is a dire need to identify the weed flora in gladiolus farms and to find their possible control measures using indigenous resources of farmers in the area for helping farming community to stabilize their economy. Keeping in view of the above, the present study was designed with the objectives (a) to identify the weed flora in gladiolus fields of the Rawalakot valley of Kashmir and (b) to test the weed management strategies using various mulching materials including a herbicide under agro-ecological conditions that are easy to apply and environment friendly.

## MATERIALS AND METHODS

The study comprised two phases; identification of major weeds flora in commercial gladiolus farms of Rawlakot valley, Azad Jammu &Kashmir, and subsequent investigation of the effect of various types of mulching materials on weeds control, growth and yield of gladiolus. The detailed methodology is given below.

### Phase I (Identification of weed flora in gladiolus)

During first phase (2008), the survey for weeds in randomly selected 10 commercial farms of gladiolus at Rawalakot valley was carried out. The weed species were collected, voucher specimen were prepared and identified by the Botany Department, The University of Poonch, Rawalakot (UPR) *AJ&K, Pakistan.*

### Phase II (Weed management in gladiolus)

### Land preparation and cultural practices

During second phase (2009), a field experiment was conducted at research farm of UPR, to study the effect of various mulching materials for weed control and growth and yield of gladiolus (Var. White Prosperity). Soil was ploughed a week before sowing, corms were planted in the last week of April by maintaining row-row distance of 30 cm and plant to plant distance of 15 cm. Planting depth was kept 8 – 10 cm. *Fertilizers (N:P:K) were applied at the rate of 100:50:50 kg* $ha^{-1}$ *with addition of* poultry litter at the rate of 7 ton $ha^{-1}$. Hoeing and irrigation (if there was no rainfall) were practiced as per requirement. Harvesting of the gladiolus was done in August, 2009.

The effect of different treatments like (1) pine saw dust (2) pine wood chips (3) wheat straw (4) plastic mulch (5) herbicide (Gesapex Combi 500 SC) as a check and (6) weedy check was investigated on their effects on weed control and various growth and yield characteristics of gladiolus. Each of the organic mulch was applied at the rate of 10 ton $ha^{-1}$ right after sowing of bulbs and its thickness was maintained up to two inches. Gesapex Combi 500 SC (*atrazine + ametryn),* was applied at the rate of 1.5 (kg a.i. $ha^{-1}$) as pre emergence, two weeks after planting the gladiolus.

Data were recorded on weed density ($m^{-2}$), plant height (cm), weight of corm (g), and weight of cormels (g), size of corm (cm) and size of cormels (cm) and yield of cormels ($m^{-2}$) of gladiolus. To record weed density, 1 $m^2$ quadrate was used and thrown randomly three times in each treatment plot. The mean of three values was used as a single treatment mean in each replication.

**Statistical analysis**

The experiment on weed management was conducted by using randomized complete block design with three replications. Data collected on various parameters were analyzed statistically according to analysis of variance (ANOVA) technique and significant means were separated using Least Significant Difference (LSD) test ($p<0.05$) using MSTAT-C (Steel *et al*., 1997).

## RESULTS AND DISCUSSION

### Phase I (Identification of Weed Flora in Gladiolus)

For higher crop production, weed identification is one of the basic components in weed management strategies. Proper identification of weed species infesting a specific crop in a particular region can help in selecting more efficient ways for their control. In the present study, 15 major weeds species in the commercial farms of gladiolus at Rawalakot valley were recorded by visual observations and identified in the Department of Botany, University of Poonch, Rawlakot, AJ&K. Data showed that the weeds recorded belonged to six different families (Table-1). Out of 15 identified weed species, seven weed species were found from family Poaceae, two from each of family Amaranthaceae, Compositeae, and Euphoriaceae and one each from the family Leguminosae and Solanaceae. It has been observed that almost half of the recorded weed species (seven) were from a single family Poaceae, which exhibits the preponderance of grasses competing with gladiolus. Another interesting observation was the presence of some winter annual weeds like *Avena fatua* and *Euphorbia helioscopia* as recorded in summer season in gladiolus fields in Rawalakot valley (Kashmir). Such a plasticity among annuals has been reported from other temperate regions of the world.

**Table-1.** Major weeds in commercial gladiolus fields during early summer 2008

| S.No | Scientific name | English name | Family |
|---|---|---|---|
| 1 | *Amaranthus caudatus* | Pig weed | Amaranthaceae |
| 2 | *Amaranthus albus* | White pig weed | Amaranthaceae |
| 3 | *Xanthium commune* | Canada cocklebur | Compositae |
| 4 | *Cirsium arvense* | Canada thistle | Compositae |
| 5 | *Euphorbia prostrate* | Ground spurge | Euphorbiaceae |
| 6 | *Euphorbia helioscopia* | Sun spurge | Euphorbiaceae |
| 7 | *Avena fatua* | Wild oat | Poaceae |
| 8 | *Cynodon dactylon* | Bermuda grass | Poaceae |
| 9 | *Lolium persicum* | Rye grass | Poaceae |
| 10 | *Poa trivialis* | Rough stalk blue grass | Poaceae |
| 11 | *Poa annua* | Annual blue grass | Poaceae |
| 12 | *Setaria faberi* | Giant foxtail | Poaceae |
| 13 | *Hodreum vulgare* | Italian barley | Poaceae |
| 14 | *Melilotus alba* | White sweet clover | Leguminosae |
| 15 | *Solanum nigrum* | Black night shade | Solanaceae |

**Phase II (Weed management in gladiolus)**

Data regarding effect of various mulching treatments on different parameters of growth and yield of gladiolus was collected and subjected to analysis of variance ($p<0.05$) and means were compared. The detail is given below:

**Weed density ($m^{-2}$)**

Weed density in gladiolus reduced significantly ($p\leq0.05$), when various mulching materials were applied (Fig. 1). The lowest number of weeds (10 $m^{-2}$) was counted in treatment covered with plastic mulch followed by application of herbicide (20 $m^{-2}$). Compared to the weedy check, where highest weed density (180 $m^{-2}$) was recorded, the organic mulches like wheat straw, pine wood chips and pine saw dust suppressed the weed population to half or even lesser (90, 80, 70 $m^{-2}$, respectively).

**Plant height (cm)**

Data presented in Fig. 2 reveals that various mulching materials significantly affected plant height of gladiolus. Maximum plant height (283 cm) was observed in corms treated with pine saw dust followed by pine wood chips (278 cm). Whereas, the minimum plant height (143 cm) was recorded in the weedy check. The

application of herbicide, although controlled weeds, but did not contribute noticeably to enhance plant height of gladiolus as compared to other mulching materials.

**Size of corm (cm)**

Effect of mulching material on corm size of gladiolus is represented in Fig 3. Various mulching materials resulted in increase of corm size variably ($p \leq 0.05$). The corm size increased maximum (6 cm) when wood chips were applied as mulch which was at par with (5.8 cm) in wheat straw. Application of herbicide and plastic mulch affected the growth of corm and its size remained to be the same as in weedy check. The respective values were 3.5, 3.8 and 3.9 cm, respectively.

**Weight of corm (g)**

Data pertaining to weight of corm as influenced by various mulching materials is shown in Fig. 4. The heavier corms (44 g) were produced under the soil covered with wood chips. Whereas, the application of herbicide and plastic mulch proved to be least affective in enhancing the growth of corms among all mulching materials after control where the lowest corm weight was recorded (24 g).

**Size of cormel (cm)**

Observations given in Fig. 5 regarding cormel size shows that covering soil with wood chip, produced cormel with larger size (2.3 cm) and was found at par with wheat straw (2.2 cm). Herbicide application and growing under plastic mulch, cormel size remained smaller (1.2 and 1.4 cm) as compared to other mulching materials (Fig. 5). When weeds were not removed from the field, particularly the smallest size of gladiolus cormels was recorded (0.6 cm)

**Weight of cormel (g)**

Data presented in Fig. 6 reveals significant differences among various weed management treatments in relation to weight of cormels. The healthiest cormels (1.5 g) were produced in wood shave mulching, whereas, wheat straw was found at par with it in this regard (1.4 g). Plastic mulch did not facilitate cormels growth and their weight remained much lower (0.9 g) than measured in all other treatments except for the weedy check which produced the cormels with lowest weight (0.7 g).

**Yield of cormels (No. $m^{-2}$)**

Various mulching materials resulted in significant differences in overall cormels yield (Fig. 7) The highest No. of cormels (102.3 $m^{-2}$) were obtained when wood chips were applied to cover the soil and control the weeds. Pine saw dust was ranked second with 90.3 cormels $m^{-2}$. Interestingly, the lowest yield of cormels (31.0 $m^{-2}$) was recorded in the treatments where herbicide was applied, which was perhaps due to the stunting and chlorosis caused by the herbicide applied.

Despite continual weed management strategies, weeds persist in agricultural fields and result in a severe loss to agricultural productivity. Weeds are the main competitor of the crops in a way that both require identical conditions for survival like soil, space, light, water, nutrients and air (Dunbabin, 2007). Decrease in the yield of agricultural crops and quality deterioration due to weed infestation has been well documented, therefore, identification of weeds is utmost important to determine their type and occurrence in crop production systems since it is a pre requisite to define their control measures (Frick and Thomas, 1992). In the present study, 15 weed species were identified infesting the commercial fields of gladiolus in Kashmir and belonged to six different families (Table 1). It has been observed that almost half of the recorded weed species (seven) were from a single family (Poaceae) and the remaining half weed species belonged to other families including Compositae and Leguminosae. These families are known to constitute the world major weed flora. Presence of *Amranthus*, *Cynodon, Euphorbia, Melilotus*, *Poa*, *Setaria* and *Solanum* species in gladiolus fields have also been reported by different scientists (Kadam *et al.,* 2014; Rao *et al.,* 2014; Swaroop *et al.,* 2014; Riaz and Javaid 2010 ; Riaz *et al.,* 2009). It is likely that presence of these weed species may cause the yield and quality losses in gladiolus as these are the common weeds found in many other crops and have been reported to compete for natural resources with the main crop (Shah and Khan 2006; Khan *et al.,* 2004; Siddiqui and Bajwa 2001). The presence of some winter annual weeds like *Avena fatua*, and *Euphorbia helioscopia,* recorded in summer season in gladiolus field in Rawalakot (Kashmir) valleys was quiet interesting. This might be due to temperate climatic conditions prevailing during summer months owing to high altitude and topographic feature of this area. Documenting these species in gladiolus field under the rain-fed conditions of Rawalakot might be helpful for establishment and extension services and for the farmers as well to design strategies for their control according to their agro-environmental conditions.

Numbers of weed management strategies have been adopted by the farmers to enhance crop yield including manual, mechanical, chemical and biological. Since many years, weed control strategy comprised chiefly of herbicides as major input and key element to sustain profitable production. However, owing to high residual effects of herbicides in soil, development of herbicide resistance in weed species and other environmental concerns associated with their continuous usage, world attention is being focused to find alternates (Ahn *et al.,* 2005). Among these alternates, mulches contribute to weed management by reducing their germination, growth, and creating favorable environment for crop by conserving soil moisture

and moderating soil temperature. In this study, effect of various mulching materials along with herbicide application has been investigated on weed density and growth and yield of gladiolus (Fig. 1 – 7). Among all treatments, it was observed that weed density reduced greatly under plastic mulch and herbicide application. Plastic mulch promotes soil warming and facilitates crop growth by blocking weed emergence (Sharma *et al.,* 2001). The herbicide (atrazine + ametryn) also reduced the weed density in gladiolus significantly as compared to other mulching treatments. This could be accredited to better weed control in early growth stages of crop by inhibiting their germination rate and overall growth, thus, providing crop plants the optimum environment to utilize growth resources efficiently. Artazine has also been reported efficient in controlling weed density by other scientists remarkably in cut flowers (Bhat and Sheikh, 2015; Kadam *et al.,* 2014). In present study, diverse mulching materials influenced various growth characteristics and yield of gladiolus differently.

Results showed that, pine wood chips induced maximum plant height, size of corms, weight of corms, size of cormels, weight of cormels and over all yield of cormels in gladiolus crop compared to unweeded control and other mulching materials (Fig. 2 – 7). Moreover, in herbicide treated plots, stunted growth of floral stalks, yellowing and burning of leaves (visual observation) reduced size and weight of corms and cormels with ultimate low yield of cormels was recorded, except for the maximum control of weed density. Because of the close proximity of many weed species with main crop, herbicide injury occurred and tuber crops may damage more than others (Fetcho *et al.,* 2001). Solaiman *et al.* (2008) worked on cut flowers and observed greater plant height with mulching treatment. It might be due to increase in soil water contents with least evaporation (Yi *et al.,* 2011). Mulching has also been documented to improves thermal properties under diverse temperatures from that of exposed soil; colder weather had higher soil temperatures than in non-mulched soils and lesser during hot weather (Sarkar *et al.,* 2007). Sufficient moisture contents and suitable temperature of soil result in taller plants and growth and yields of corms. Another reason for the better growth and yield of gladiolus under mulched soil might be availability of nutrients to the plants in root zone. Thus, enhances root growth, ultimately leads to increase in the potential for better growth. Therefore, mulching is beneficial to improve soil physical, biological and chemical conditions for better crop growth and yield attributes.

## CONCLUSION

A survey was conducted and it was found that 15 weed species are major weeds of gladiolus that greatly affect the yield and quality of

flowers. In light of the survey, weed management studies showed that all weed management techniques were effective in controlling weeds which ultimately affected the growth and yield related attributes of the gladiolus. Therefore it is recommended that weeds should be managed in gladiolus to get higher yield.

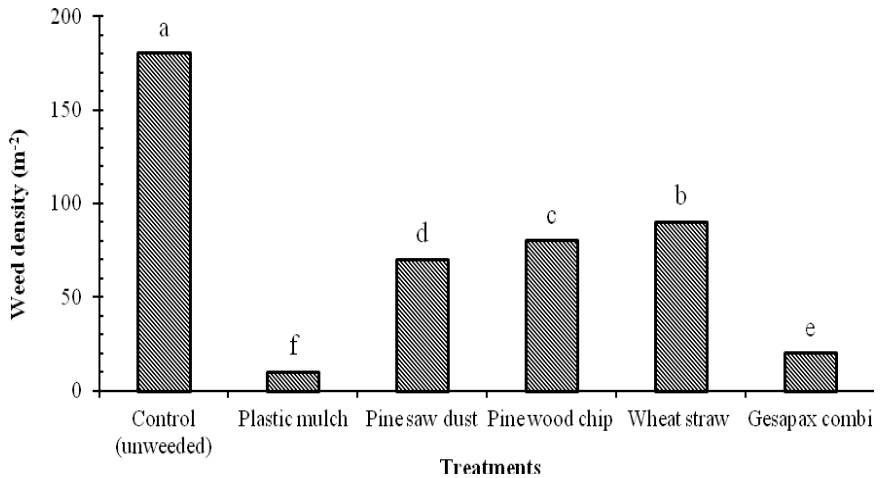


Figure 1. Effect of weed management on weed density ($m^{-2}$) in gladiolus.

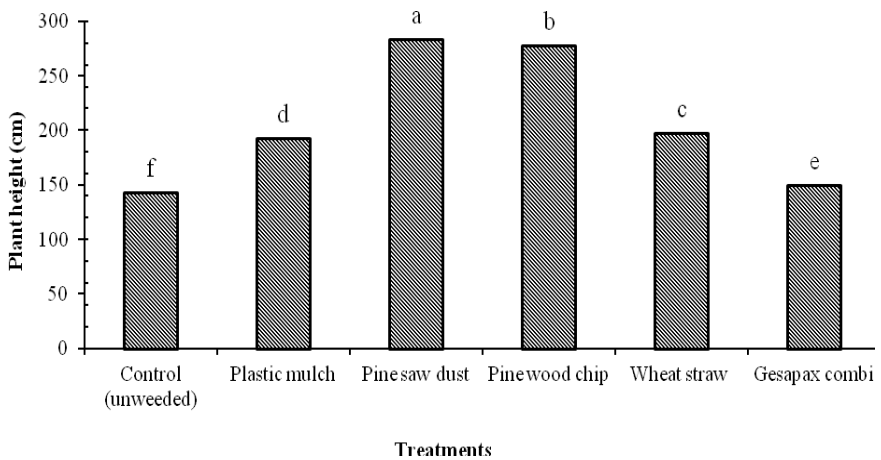


Figure 2. Effect of weed management on plant height (cm) of gladiolus

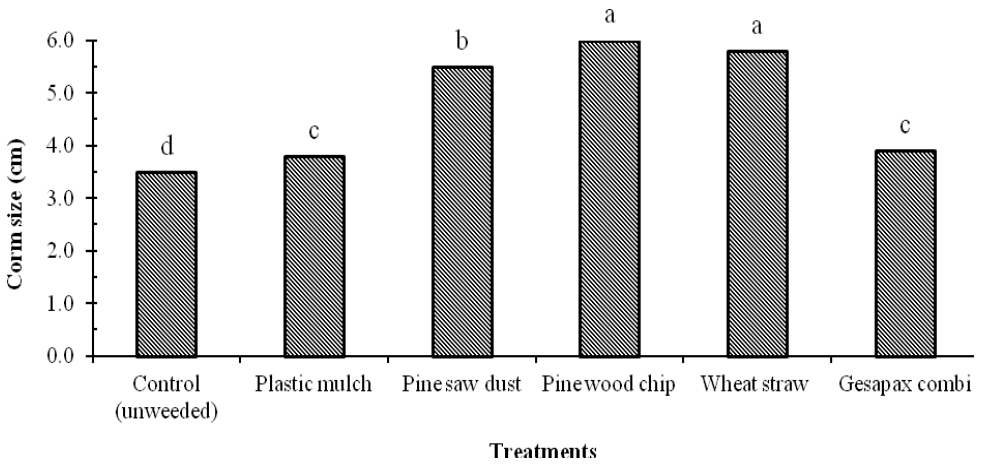


Figure 3. Effect of weed management on corm size (cm) of gladiolus.

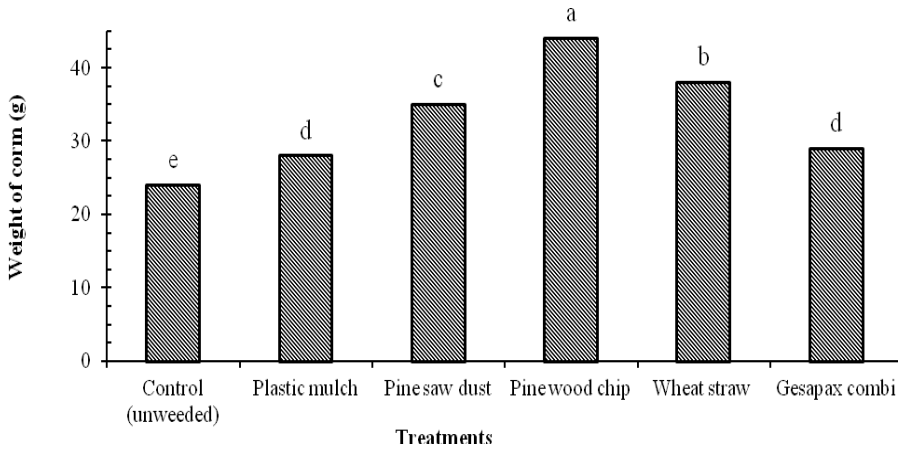


Figure 4. Effect of weed management on weight of corm (g) of gladiolus.

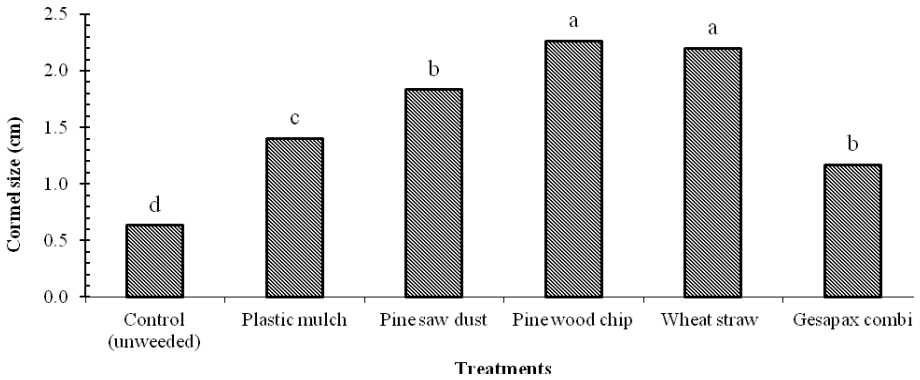


Figure 5. Effect of weed management on cormel size (cm) of gladiolus

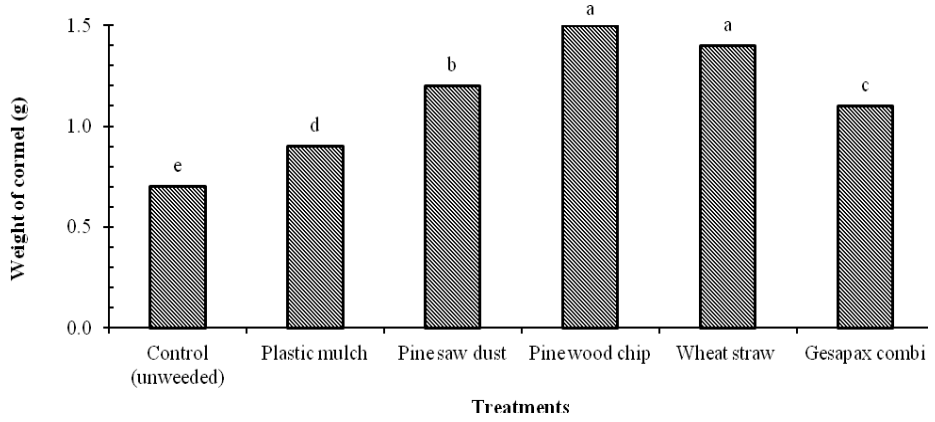


Figure 6. Effect of weed management on weight of cormel

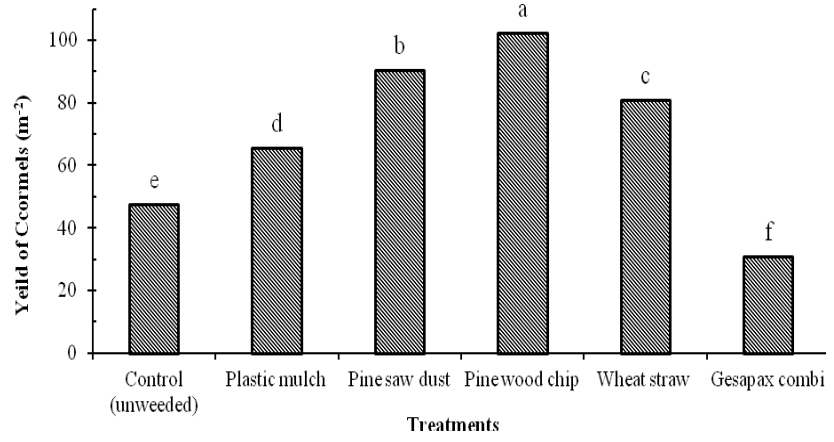


Fig. 7. Effect of weed management on yield of cormel of gladiolus

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